

FRENCH (T. R.)

*Compliments of*  
DR. T. R. FRENCH.

ON PHOTOGRAPHING THE LARYNX.

BY

THOMAS R. FRENCH, M.D.,  
BROOKLYN.



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Fig 1



Fig 2



Fig 3



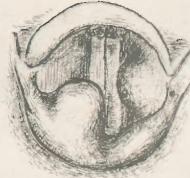
Fig 4



Fig 5



Fig 6



Drawing of the same laryngoscopic image as that of which photograph shown in Fig 5 was taken

## ON PHOTOGRAPHING THE LARYNX.\*

By THOMAS R. FRENCH, M.D.,

BROOKLYN.

*(With plate and two wood-cuts.)*

AT the last session of this Association, I presented several photographs of the larynx taken with the assistance of Mr. George B. Brainerd, of Brooklyn, only a few days before the meeting.

Since then we have made numerous experiments with various forms of apparatus, all of which have been constructed by Mr. Brainerd.

This gentleman's assistance has been simply invaluable. He is a civil engineer by profession, and became interested in the larynx and laryngoscopy immediately after I had incised an abscess in his larynx, which had begun to interfere with respiration. I soon succeeded in teaching him to examine his own larynx, and seeing that he was much interested in the study of its movements, and knowing him to be an expert amateur photographer, I broached the subject of photographing the laryngoscopic image. He entered into the solution of the question with the spirit of scientific inquiry, and, because of his untiring industry and great ingenuity, has been mainly instrumental in enabling me to present to-day these photographic pictures of the interior of the larynx.

We demonstrated last year that the larynx could be photographed, but with that process the throat-mirror and camera were in fixed positions, and the head of the patient had to be drawn up to the mirror and arranged to suit its position, which of course necessitated very tolerant fauces in order to succeed. We realized that photographs taken

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in this way could have but a limited value in the study and demonstration of diseases of the larynx, and, therefore, our objects this year have been :

1. To simplify the procedure, and so convert that which before was only an interesting experiment into an operation of practical utility.

2. To take a better photograph.

In the fulfilment of both of these objects we believe that we have been successful, for, as I shall show farther on, we have adapted a hand-camera, with which the larynx of persons having only fairly tolerant fauces can, in the majority of instances, be photographed by any laryngoscopist; and I have for presentation to-day a number of photographs taken with the stationary apparatus, which are an improvement on the results of last year.

The hand-camera will not produce as large or as satisfactory pictures as the stationary apparatus, but, as the results of some of the work done with it will show, they are clear enough to make out the various structures of the normal larynx, or diseased conditions if they exist.

The photographs shown last year were taken with a camera about the size of a segar box placed upon a tripod, and with the throat-mirror attached by a flexible rod to the camera. Unaided sunlight alone was used for illumination. The best photograph taken with that apparatus is probably familiar to all the Fellows of the Association. The sources of illumination used in the experiments made this year were unaided sunlight, condensed sunlight, oxyhydrogen, magnesium, and electric lights.

With unaided sunlight plane reflectors were used. In order to increase the power of illumination from sunlight, and at the same time to avoid material increase of heat, Mr. Brainerd devised and constructed a condenser, which answers the purpose so well that it deserves a description. It consists of a box 10 inches long, in one end of which is placed a double convex lens 5 inches in diameter, which has a focal distance of 13 inches. At the outer end of a short tube fitted into the other end of the box is a plano-concave lens  $1\frac{7}{8}$  inches in diameter. This is placed an inch

or so inside of the point of focus of the double convex lens, and in that position intercepts the converging rays, and makes them parallel or divergent, according to its distance from the first lens.

When sunlight is made to pass through these lenses the result is one of the most beautiful and powerful lights, without material heat, that I have ever seen. Both light and heat can be controlled by diaphragms of varying size, to be introduced between the lenses when the sun is very bright.

With this condenser both the plane and concave reflectors were used. The electric-light used was produced by one of Wood's 6,000 candle-power focussing lamps, which the Fuller Electric Light Co. courteously placed at our disposal for our experiments. A 2,000 candle-power Fuller lamp, such as is used for street illumination, was suspended from the ceiling by a rope and pulleys for our use, but the light produced by it was found to be too small and weak to illuminate all of the larynx at the same time. It was therefore discarded without experiment, and Wood's powerful focussing lamp without the reflector substituted.

With this light reflected from both plane and concave reflectors, sixteen exposures were made with the small camera. The best results were obtained from the use of the plane reflector; but the photographs taken in this way were no better than those resulting from the use of unaided sunlight, and not as satisfactory as those obtained when condensed sunlight was employed.

The illuminating power of this light could certainly have been increased by the use of a condenser, but the experiment was not made, for the light as it was, proved to be very trying and dazzling to the eyes of both Mr. Brainerd, upon whom the experiments were made, and myself.

The experiments with sunlight were made with a variety of cameras, all of which, with the exception of two, have been discarded. Of these, one is a stationary camera and the other is intended to be held in the hand while the photograph is being taken.

The stationary apparatus consists of two tubes, one inch

in diameter, moving one within the other. The lens, a plano-convex achromatic of five inches focus is set in the distal extremity of the outer tube, and an ordinary plane or concave reflector is suspended in front of it; upon the side of the tube an adjustable arm is fixed, which carries the throat-mirror; at the other end of the inner tube is the exposing apparatus, consisting of a perforated drop shutter and a slide for the holders containing the sensitive plates. The whole is fixed to a flat wooden base.

Here are a number of photographs (see plate ~~facing page 235~~ of the larynx taken with this apparatus, which are presented to show what can be done. While they are much better than those of last year, they are of no great practical value, for in order to secure them the patient and camera must be placed in fixed positions, which precludes the pos-

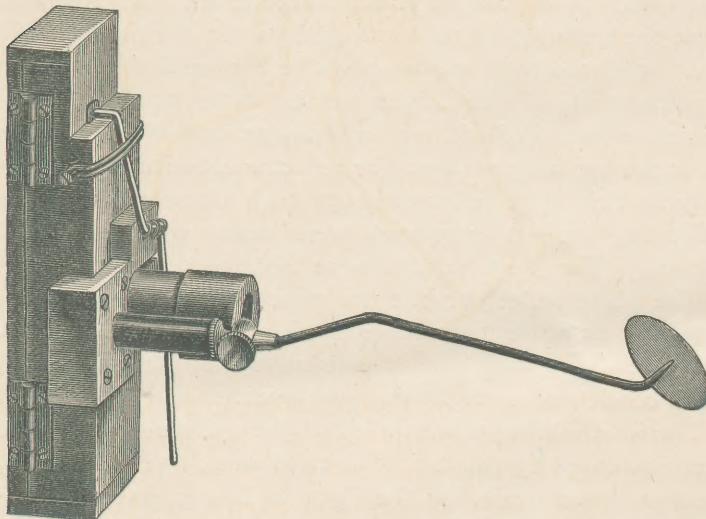


FIG. I.

sibility of using the apparatus upon a large majority of patients who come under observation.

(Figs. 1, 2, 3, and 4 of plate are artotype reproductions of the best photographs taken with the stationary camera exhibited at the meeting at which this paper was read. The reproductions are, of course, not as clear as the photographs.)

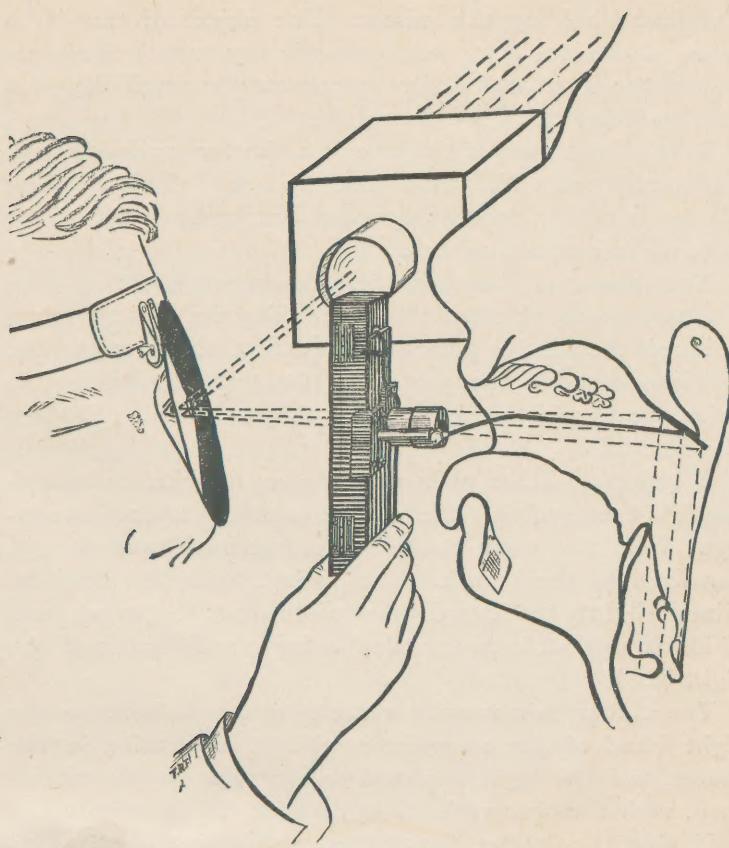


FIG. 2.

The small camera (Fig. 1) is intended to be held in the hand while the picture is being taken. It consists of a box  $4\frac{1}{2}$  inches long,  $1\frac{7}{8}$  inches wide, and  $\frac{3}{4}$  of an inch in thickness. The back opens upon hinges, and admits of the introduction of either the ground glass or plate-holder. On the anterior face, a tube  $1\frac{1}{8}$  inches long is attached, in the outer end of which the lens is placed. This lens has a focus of  $1\frac{1}{4}$  inches.

At the side of the tube a part of the handle of a throat-mirror is fixed, and into that the shank of a throat-mirror is passed and fastened by a thumb-screw. The shank of the mirror is somewhat curved, and is attached to the side of

the frame holding the mirror. The object of this is to allow of the lens being held opposite any part of the opening of the mouth, and also to prevent the possibility of a shadow being cast upon the mirror.

In the front part of the box is a shutter made of lead, and perforated with a hole just the size of the lens. The shutter is held in position by a lever acting as a key, on the anterior face of the camera.

The apparatus is used in the following manner:

I have sketched upon this plate (Fig 2. shows the plate reduced) the relative positions of patient, observer, camera, and condenser in the procedure about to be described, a reference to which will, perhaps, aid you in understanding the description.

A reflector, either plain or concave, attached to a head-band, is arranged over the left eye so that the pencil of sunlight from the solar condenser is received upon it and thrown into the mouth. The patient, with the head inclined slightly backward, now protrudes the tongue and holds it well out between the forefinger and thumb of the right hand.

The throat mirror with camera attached, held in the right hand of the observer, is placed in position in the fauces, and the light adjusted so that the larynx can be seen, with the observer's left eye, to be well illuminated.

If, now, the tongue does not mound up above the level of the lower edge of the lens, and the lower edge of the mirror, it may be taken for granted that, when the plate is exposed, the picture received upon it will be nearly the same as that seen with the left eye in the throat-mirror. The photograph is taken by pressing upon the key with the index finger; this releases the shutter which, in falling, makes an instantaneous exposure, amounting, perhaps, to one seventh of a second.

In using condensed sunlight with the small camera, it is important to throw the circle of light from the inner side of the reflector—that nearest the nose,—for in this way a part of the larynx exposed to the lens of the camera may be illuminated, which cannot be seen with the eye. To insure

this, it is best to cover the outer half of the reflector with black silk.

On account of the parallax or displacement of the image due to the difference in point of view between the eye and the camera, some skill is necessary in managing the illumination, so that the part which it is desired to bring out will be exposed to the lens if not to the eye.

Here are a number of photographs taken with this, the small camera, showing normal and diseased larynges in various positions. Some of them are so small—the pictures of the larynx themselves measuring only about  $\frac{1}{8}$  or  $\frac{3}{16}$  of an inch in diameter—that they cannot be satisfactorily seen without the aid of a magnifying glass. In order to make them clear to the unaided eye it is necessary to enlarge them. On account of the short time which has elapsed since these photographs were taken, satisfactory enlargements could not be obtained. (Fig. 5 of plate is an artotype reproduction of one of the many photographs taken with the hand-camera exhibited at the meeting at which this paper was read. It does the photograph great injustice, but is shown because of the fact that it is *the first photograph taken of the image of a diseased larynx*. It represents perichondritis in laryngeal phthisis. Fig. 6 of Frontispiece is a reproduction of a photograph of a portion of the rhinoscopic image taken with the hand-camera. It shows hypertrophied membrane, due to catarrh, on both sides of the septum, and portions of the middle and inferior turbinated bones of the right side.)

These photographs are not as large or clear as desirable, but allowance must be made for the fact that an ordinary plano-convex achromatic lens was used, which was not constructed with any special reference to photography, and the pictures taken with it bear about the same relation to those that would be produced by a regularly constructed photographic lens, that the tin-type of the itinerant photographer bears to the imperials of a Sarony or a Kurtz.

It may be asked, Why have we not used the best lens that could be obtained? to which we would answer that our plan from the first has been: first, to attain the result

aimed at, and this has only just been reached; and then to eliminate objectionable features and perfect the product.

Any want of sharpness in the views must be attributed to the imperfection of the lens or inaccuracy in focussing, for the closest inspection will not show any duplication of lines, such as would result from a movement of the parts during exposure.

Experience has shown that the apparatus may be improved in several ways. By adding a larger lens the size of the pictures could be doubled, without increasing the size and weight of the present camera more than one third.

Mr Brainerd suggested the following, and had time allowed, the suggestions would have been carried out:

The use of a wide-aperture combination lens to flatten the field and increase the sharpness of the image. The addition of a micrometer for more delicate focussing, and to contribute to the sharpness of the image. The use of an exposing drop to be actuated by a spring instead of by gravity, in order to shorten the exposure when the light will warrant it. This might be placed in front of the lens to protect it from the breath of the patient. Setting the lens on one side of the centre of the plate to give a more nearly coincident vision of eye and camera.

The development of the plates is a very simple matter, and a knowledge of it can be readily acquired, so in taking pictures with the hand-camera the services of a photographer are not necessarily required.

The results of the experiments made this year may be summed up as follows:

1. Better photographs have been taken with the stationary apparatus than those of last year.
2. A camera has been so adapted that it can be held in the hand and quickly placed in position. This makes it possible to photograph the larynx in patients whose fauces are only moderately tolerant.
3. The photographs are taken instantaneously, by a drop shutter, thus making it possible to photograph the larynx, even if the parts are in motion.
4. The parts reflected in the mirror are alone exposed,

thus avoiding the confusion which arises when the mouth and lips are included and out of focus.

5. As the apparatus is so small, and the exposure is made instantaneously, if desirable, photographs can be taken without the patients being aware of the object of the procedure.

6. Several diseased conditions of the larynx have been photographed. This is an important step in advance, for we believe that it is the first time that it has been accomplished.

7. Portions of the rhinoscopic image have been photographed. These photographs show, among other things, hypertrophy of the mucous membrane covering the posterior portion of the nasal septum.

So far as we are aware, this is the first time that any portion of the posterior nares has been photographed.





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